

REMARKS

Claims 1-22 are pending after the amendments. All amendments relate to controlling the restriction through which gas exits the chamber, where the restriction device that is controlled is within or part of the chamber itself. One example of the claimed exit-flow restrictor is described in the specification starting on page 21 and shown in Figs. 14-17.

Controlling the conductance of gas exiting the process chamber by controlling a restriction device within the chamber or forming a part of the chamber has various advantages. Firstly, conventional processing systems control a gas flow restriction device (such as a valve) that is located between the gas source and the entrance to the chamber. However, although incoming gas flows eventually exit the system, the total gas flux delivered to the substrate processed in the process chamber is a sum of the incoming gas flux plus the ever present gas flux due to leaks into the process chamber, however minute. By controlling the conductance of gas exiting the chamber, impurities introduced by these gas leaks into the system and their negative impact on process is substantially reduced.

Secondly, by locating the restriction device within the chamber or as part of the chamber, the gas volume to be controlled is minimized, as compared to the case of employing discrete restriction devices that are located external to the chamber, whether upstream or downstream of the chamber. By reducing the volume of gas to be controlled to a minimum, the time constants for the system gas dynamics are also minimized, resulting in faster flow control response times, and the gas flow can be more accurately controlled. Although less important for steady flow, high gas flux reactions such as chemical vapor deposition wherein the gas flows are maintained for long periods of time until the desired film thickness is reached, fast gas dynamics are especially important in low gas flux reactions such as atomic layer deposition due to the cyclic nature of the deposition reaction.

Accordingly, Applicants' inventions of the independent Claims 1, 19, and 20 provide a significant improvement over prior art systems as will be described below.

OBJECTION TO THE SPECIFICATION

The Examiner objected to the specification since the declaration indicates that the application claims priority to U.S. Application Serial No. 09/902,080, but page 1 of the

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specification states that the present application claims priority to U.S. Application Serial No. 09/999,636.

The present application is a continuation of U.S. Application Serial No. 09/999,636, which is a CIP of Application Serial No. 09/902,080. Accordingly, the declaration is correct, and for clarity purposes, the specification has been amended to further identify the parent application 09/902,080.

REJECTION OF CLAIMS UNDER 35 U.S.C. 112

The Examiner rejected Claims 1 and 20 since the Examiner believed it was not clear if the second and third mention of "conductance" is the conductance of the outlet stream or the conductance that is implicitly present in other parts (i.e., inlet) of the chamber.

Claims 1 and 20 have been amended to further clarify the "conductance." The first step of Claim 1 recites that the "gas flow conductance is defined for gas exiting the chamber." The subsequent uses of the word "conductance" have been clarified as being "the gas flow conductance" so as to refer back to the previous identification of "gas flow conductance." Accordingly, the second and third mention of "conductance" in Claim 1 refers to the gas exiting the chamber.

Similar amendments have been made to Claim 20. Accordingly, the rejection to Claims 1 and 20 under 35 U.S.C. 112 has been overcome.

The Examiner also rejected Claim 19 and stated that it is unclear to which "conductance" it refers to. Claim 19 has been amended to make clear that the conductance is of the gas exiting the chamber. Accordingly, the rejection of Claim 19 has been overcome.

REJECTION OF CLAIMS UNDER 35 U.S.C. 102

The Examiner rejected independent Claims 1 and 19 as being anticipated by Sherman (U.S. 6,342, 277). The Examiner also rejected the independent Claims 1, 19 and 20 over a combination Suntola (U.S. 4,412,022) in view of Suzuki (U.S. 2001/0048981 A1) and Tanaka (U.S. 5,091,207).

Claim 1 has been amended to state that "varying the gas flow conductance comprises moving a restriction device within the chamber or forming part of the chamber to vary a

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restriction through which gas exits the chamber.” The advantages of moving a gas restriction device within or forming part of the chamber to vary the exit gas flow conductance has been discussed above.

The references cited by the Examiner all teach valves that are external to the chamber, whether the valves are between the gas source and the input of the chamber or between the outlet of the chamber and a vacuum source. Specifically, Sherman opens and closes external valves 86 and 20 (Fig. 1) to move gas in and out of the chamber (column 6, lines 27-44). Suntola controls the gas flow by controlling external input valves 21 (Fig. 5, column 4, lines 38-52). Suntola also teaches to control the gas flow using a diffusion barrier (Fig. 6) near the entrance to the process chamber and teaches other techniques that control gas flow by means external to the chamber. Suzuki, in Fig. 3 and in other figures, describes a gas conductance valve 218 that is external to the chamber. Tanaka teaches external valves V1-V4 in Fig. 4B.

As seen, all of the prior art references teach valves or other gas control devices external to the chamber. Accordingly, Applicants’ Claims 1 and 19 cannot be suggested by the cited references and are respectfully submitted to be patentable.

The Examiner rejected Claim 20 as being obvious in view of Tanaka. The Examiner equated Tanaka’s external valves (presumably valves V1-V4 in Fig. 4B) to the claimed movable “shield defining a periphery of the chamber.” As described above, by providing a chamber with a restriction device forming either part of the chamber or within the chamber provides advantages over valves external to the chambers. The Tanaka valves V1-V4 are conventional external valves, while Applicants’ “moving a shield defining a periphery of the chamber” is a very unconventional means of controlling gas flow conductance. There is no suggestion in the prior art to somehow modify Tanaka’s chamber 10 to incorporate a movable shield defining a periphery of the chamber to vary gas flow conductance. Accordingly, Claim 20 is submitted to be non-obvious in view of Tanaka. Moreover, the plurality of valves taught in Tanaka’s patent create a multitude of discrete exits to the process chamber. In high gas flux reactions such as CVD, the small variations in gas flow resulting from these discrete apertures may be insignificant, but in low gas flux reactions such as ALD, only a continuous or largely continuous controllable conductance such as the claimed movable “shield defining a periphery of the chamber” can achieve the desired superior process uniformities.

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Various ones of the dependent claims were rejected by the Examiner in view of the combination of the art mentioned above. Since the independent claims have been shown to be patentable over the cited art, there is no need to discuss the patentability of the individual dependent claims.

Accordingly, is respectfully submitted that all claims are patentable over the cited references.

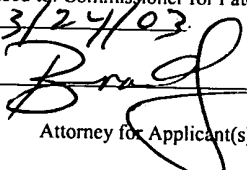
DOUBLE PATENTING REJECTION

The Examiner rejected the claims under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 58-75 of co-pending application 09/902,080.

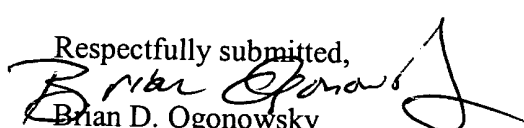
Since the '080 application has not yet been patented, it is respectfully submitted that it is premature to analyze whether a terminal disclaimer is appropriate.

CONCLUSION

Accordingly, it is respectfully submitted that the Examiner allow all claims. If the Examiner's next action is other than the allowance of the claims, the Examiner is respectfully requested to call Applicant's attorney at (408) 382-0480.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231, on <u>3/24/03</u>	
 _____ Attorney for Applicant(s)	<u>3/24/03</u> _____ Date of Signature

Respectfully submitted,


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